Evaluation of Russian Made MC&A Equipment for the MPC&A Program

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Background

- The Materials Protection, Control and Accounting (MPC&A) Program was started in 1994 to improve security of nuclear materials in the FSU.
- Initially US material control and accounting (MC&A) equipment was used
  - Easy to obtain
  - US personnel familiar with operation
  - Lack of knowledge about Russian equipment
  - In FSU there was little experience with Nondestructive Assay (NDA)

    Experience gained using US methods and equipment showed benefits of NDA for Material Control and Accounting (MC&A)
- This approach was found to have drawbacks
  - Lack of Russian language support
  - Difficulty of obtaining service and parts
  - Lack of certification and attestation

Early steps

- A MC&A instrumentation catalog was first compiled by BNL in 1998; updated in 1999
  - Included Russian and US equipment
  - Provided information about instruments and performance specifications
    - It was basically a sales catalog
  - The catalog lacked information about actual performance
- The Program realized a need for more information on Russian MC&A instruments that could be gained through their evaluation.

An Evaluation of Russian MC&A Instruments was Started

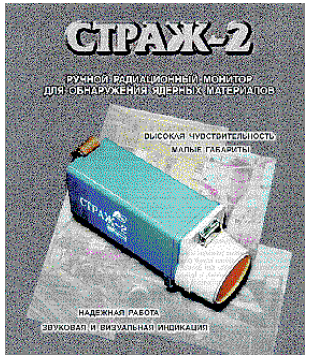
- Purpose

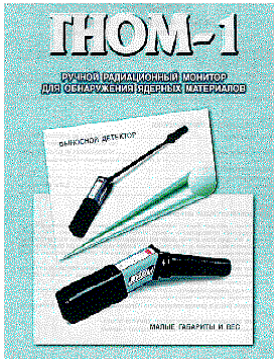
  Support long-term use of MC&A instruments and measurement methods in MinAtom facilities and by GAN inspectors (sustainability)

- Approach
  - Support use of indigenous equipment
  - Help develop Russian MC&A infrastructure
- Actions
  - Identified Russian suppliers and acquire hardware
  - Tested performance
    - Accuracy, precision, reliability, lifecycle support
    - Some testing in Russia, some in US
  - Prepared a “Consumer Report” on Russian MC&A equipment for use by MC&A teams

NDA instruments built in Russia were evaluated

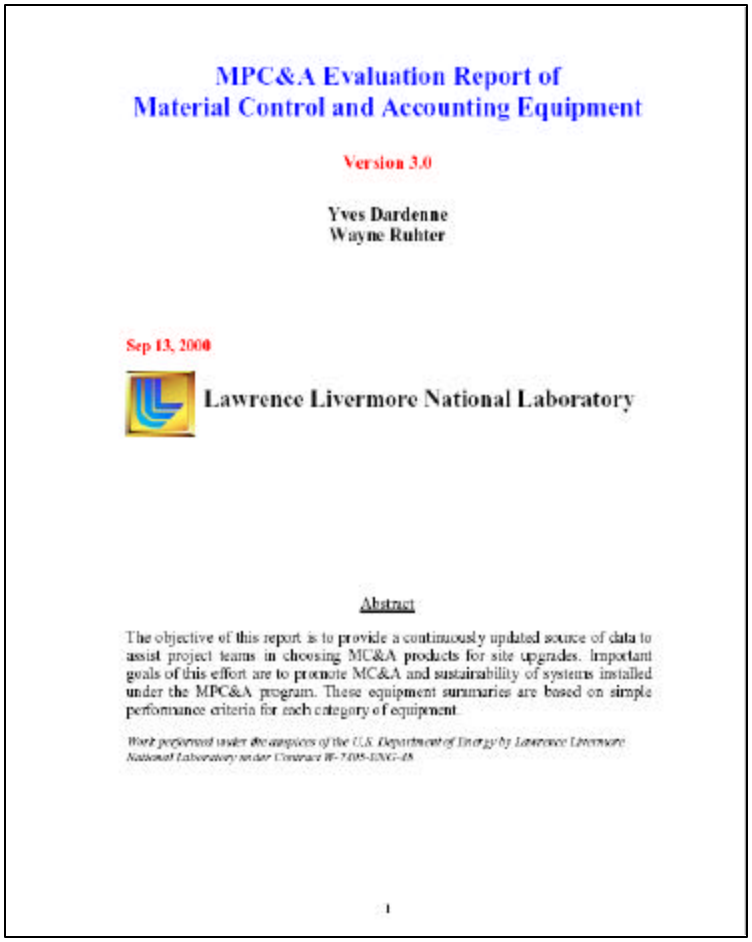
- Gamma ray spectrometers (8)
- Neutron coincidence counters (3)
- Hand-held monitors (8)
- Portal monitors (13)
- Detectors (2)
- TIDs (2)





Products from 12 vendors evaluated

“Consumer Report” on Russian MC&A Instruments



MPC&A Evaluation Report of
Material Control and Accounting Equipment

Version 3.0

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Sep 13, 2000

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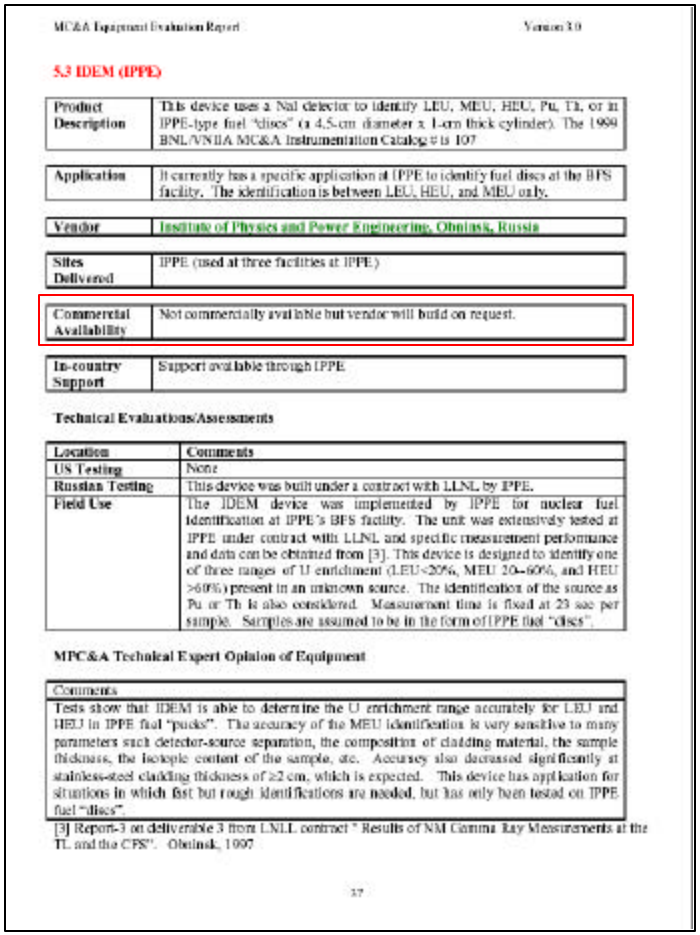
Abstract

The objective of this report is to provide a continuously updated source of data to assist project teams in choosing MC&A products for site upgrades. Important goals of this effort are to promote MC&A and sustainability of systems installed under the MPC&A program. These equipment summaries are based on simple performance criteria for each category of equipment.

Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.



5.3 IDEM (IPPE)

Product Description	This device uses a NaI detector to identify LEU, MEU, HEU, Pu, Th, or in IPPE-type fuel “discs” (a 4.5-cm diameter x 1-cm thick cylinder). The 1999 BNL/VNIIA MC&A Instrumentation Catalog # is 107
Application	It currently has a specific application at IPPE to identify fuel discs at the BFS facility. The identification is between LEU, HEU, and MEU only.
Vendor	Institute of Physics and Power Engineering, Obninsk, Russia
Sites Delivered	IPPE (used at three facilities at IPPE)
Commercial Availability	Not commercially available but vendor will build on request.
In-country Support	Support available through IPPE

Technical Evaluations/Assessments

Location	Comments
US Testing	None
Russian Testing	This device was built under a contract with LLNL by IPPE.
Field Use	The IDEM device was implemented by IPPE for nuclear fuel identification at IPPE’s BFS facility. The unit was extensively tested at IPPE under contract with LLNL and specific measurement performance and data can be obtained from [3]. This device is designed to identify one of three ranges of U enrichment (LEU<20%, MEU 20--60%, and HEU >60%) present in an unknown source. The identification of the source as Pu or Th is also considered. Measurement time is fixed at 23 sec per sample. Samples are assumed to be in the form of IPPE fuel “discs”.

MPC&A Technical Expert Opinion of Equipment

Comments
Tests show that IDEM is able to determine the U enrichment range accurately for LEU and HEU in IPPE fuel “pucks”. The accuracy of the MEU identification is very sensitive to many parameters such detector-source separation, the composition of cladding material, the sample thickness, the isotopic content of the sample, etc. Accuracy also decreased significantly at stainless-steel cladding thickness of ≥2 cm, which is expected. This device has application for situations in which fast but rough identifications are needed, but has only been tested on IPPE fuel “discs”.

[3] Report-3 on deliverable 3 from LNIL contract " Results of NM Gamma Ray Measurements at the TL and the CFS". Obninsk, 1997

What have we learned from the MC&A instrument evaluation?

- Helped identify the need for reference materials

  This is being addressed through the MC&A Measurements Project
- Provided feedback to manufacturers
- Regulations on use of methods and equipment are evolving
  - Certification of methodology
  - Certification of instrumentation
  - Certification of individuals/facilities to use methodology
  - Several levels and dimensions of “certification”
    - Federal and Enterprise
    - Safety, Performance, Security
  - This has lead to confusion on what is required

Russian Testing Processes

- Gosstandart of Russia (GOST R)
  - ➢ Long-standing process
  - ➢ Covers essentially all products
    - > Bottled water to mass spectrometers
    - > Additional certifications for certain products
  - ➢ Based on conformity and authenticity
  - ➢ Type of certification
    - > Type – product/ model certifcation, broader certification; required if the instrument is going to be used for “official” measurement purposes
    - > Single – single instrument, single site use
  - ➢ Voluntary or obligatory depending on type of product and intended use

ГОСУДАРСТВЕННЫЙ
КОМИТЕТ РОССИЙСКОЙ ФЕДЕРАЦИИ
ПО СТАНДАРТИЗАЦИИ И МЕТРОЛОГИИ
(ГОССТАНДАРТ РОССИИ)

СЕРТИФИКАТ

PATTERN APPROVAL CERTIFICATE
OF MEASURING INSTRUMENTS

DE.E.31.005.A № 13172

масс-спектрометра Trition Ti

Фирма "Finnigan MAT", Германия

Russian Testing Processes

- Equipment, Products and Technologies (OIT)
  - New
  - Performance-based
  - MinAtom, GAN, and Gosstandart all have responsibilities
  - Testing to be done by accredited laboratories
  - Certification issued by body of experts
  - Mandatory for all equipment used in nuclear facilities
  - GOST R certification necessary part of OIT process

OIT Testing Center for NDA Equipment

- Under MPC&A support the Institute of Physics and Power Engineering has developed detailed plans to become an accredited OIT and Gost R testing center for NDA equipment.
  - Precision and Accuracy Testing (Gost R)
  - Functional and Environmental Testing – moisture, vibration, fields
- MPC&A Certification Project studying how OIT process is being implemented.
- Final decision on implementing the IPPE plan is pending.

What is the future for the MC&A instrument assessment project?

- Project was intended to jump start the transition to indigenous equipment by providing data on what was available to the teams installing MC&A upgrades.
- As the program moves to sustainability, further support of this type of testing is being reviewed.
- Evaluation of a Russian mass spectrometer is an exception.
  - Currently, a Russian source of mass spectrometers is non-existent.
- Expectation is that new equipment will go through Russian testing process that is now evolving.

Russian Mass Spectrometer

- Thermal Ionization Mass Spectrometry used for isotopic measurements in uranium and plutonium
- Commercial instruments
  - Expensive, >$600K
  - Hard to maintain in Russia
- MinAtom is building an indigenous TIMS
  - Expect to install them throughout MinAtom complex
  - Cost expected to be ~$200K
  - Sustainable in Russia
- Working with Bochvar Institute to evaluate performance
- Evaluation will provide basis for recommending source of TIMS instruments to MPC&A Program

Summary

- The MPC&A Program is moving from rapid upgrades to sustainable MPC&A operations and infrastructure.
- The MPC&A Program has supported for a long time the use of indigenous MPC&A equipment to sustain its use.
- The Program needed to know what Russian MPC&A equipment was available and how it performed.
  - MC&A equipment catalog
  - Evaluations have been performed
  - Consumer Report on MC&A equipment
- Conformance with certification requirements is being discussed